Agilent 8495D/K Attenuators

Operating and Service Manual

Agilent Technologies

Notices

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This manual contains operating instructions for the Agilent 8495D/K Attenuators. Included in the manual is information required to install and test these attenuators.

Product Overview

The Agilent 8495D and 8495K are 50-ohm, dc to 26.5 GHz, 0 dB to 70 dB (in 10 dB steps), coaxial attenuators with APC 3.5 connectors. Each attenuator is made up of four attenuation sections connected in cascade. Each section consists of a precision thin-film attenuator card, a lossless thru-line, and a ganged pair of edge line transmission lines. The edge lines are flexed to make contact with either the attenuator card or the thru-line. The edge line contacts are gold-plated leaf springs which ensure long life and high repeatability. In the 8495D, the edge line controls are flexed by low-torque cams. In the 8495K, the edge line controls are flexed by solenoid plungers (see Figure 1).

Table 1 on page 12 shows the switching arrangement required to increase the amount of attenuation from 0 dB to 70 dB in 10 dB steps. In the 8495K, to ensure specified performance, it is recommended that the attenuator sections shown in the table below be used. Also, when changing attenuation, it is good practice to insert the required sections before deletion of the unneeded sections. With the attenuator set for 0 dB attenuation, only the insertion loss (residual attenuation) remains.

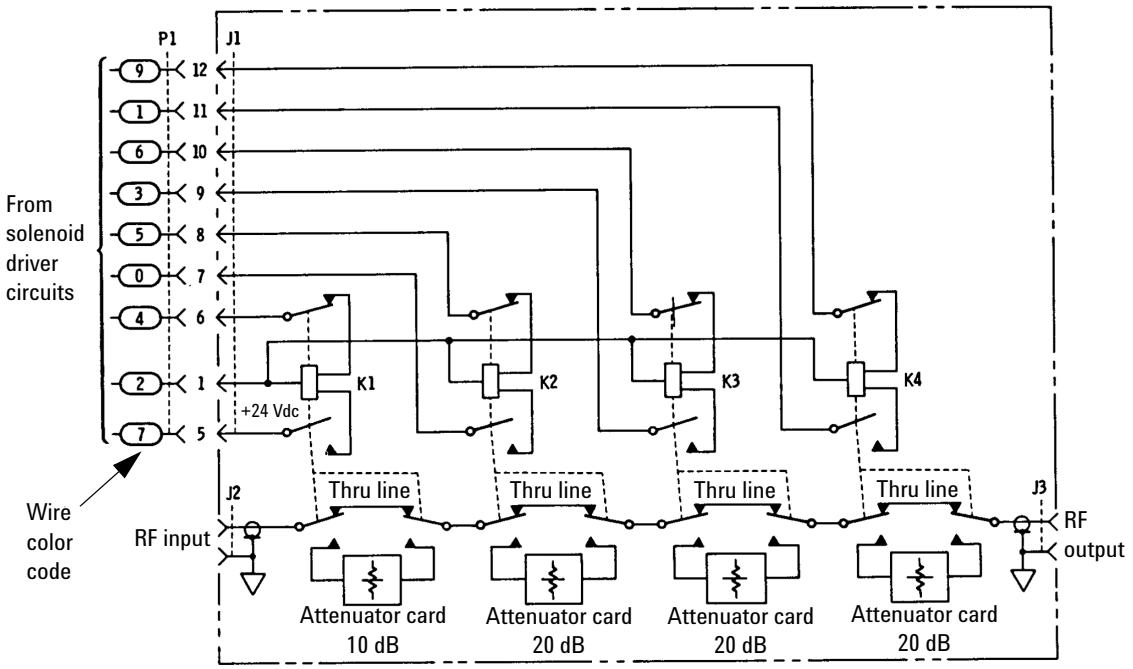

Figure 1 8495K Programmable Four-Section Attenuator Schematic Diagram

In the 8495K, each solenoid requires a drive of 20 V to 30 V. The switching current is approximately 125 mA at 24 Vdc per section for the 8495K. The solenoid switching time is less than 20 milliseconds including settling time. Once switched, the solenoid plungers are held in place by permanent magnets and the solenoid plungers automatically disconnect the selected coil drive and connect the opposite coil drive (see Figure 1 on page 11 and Figure 3 on page 14).

Table 1 Attenuator Switching

Attenuator Sections				
Attenuation (dB)	**1 10 dB**	**2 20 dB**	**3 20 dB**	**4 20 dB**
10	×			
20			×[1]	×[2]
30	×		×[1]	×[2]
40		×		×
50	×	×		×
60		×	×	×
70	×	×	×	×

[1] D model only

[2] K model only

CAUTION Do not exceed the RF power rating of 1 W average or 100 W peak with a maximum pulse width of 10 µs. Do not connect an attenuator RF input or output connector to greater than ±7 Vdc. If the attenuator must be connected to a device with a potential greater than ±7 Vdc, use a blocking capacitor.

Supplied Accessories

A solenoid drive cable is supplied with the 8495K. The cable is 1.5 m (5 ft) long with a mating connector plug on one end and the other end is unterminated (see Figure 2 on page 13).

Solenoid Cable Connectors

Refer also to Figure 2 on page 13.

Table 2 Solenoid Cable Connectors

Section	Section 1		Section 2		Section 3		Section 4		Power V+
Solenoid Coil	Thru-Line	Atten Card	Thru-Line	Atten Card	Thru-Line	Atten Card	Thru-Line	Atten Card	
Cable Wire Color Code[1]	PUR	YEL	BLK	GRN	ORN	BLU	BRN	WHT	RED
Connector Plug Pin Number[2]	5	6	7	8	9	10	11	12	1
8495K	0 dB	10 dB	0 dB	20 dB	0 dB	20 dB	0 dB	20 dB	–
Option 016 Flat Pack Plug Pin Number[3]	13	2	11	5	3	9	4	10	6

[1] Five-foot cable and mating plug assembly provided.

[2] Pin 1 (red wire) is common for all coils. Pins 2, 3, and 4 are not used.

[3] Pin 6 is common for all coils. Pins 1, 7, 8, 12, and 14 are not used.

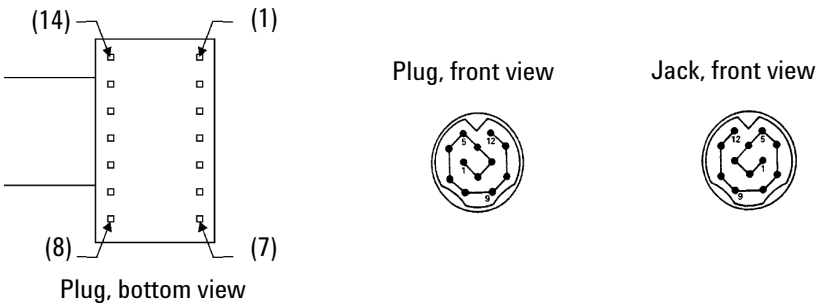

Figure 2 Solenoid Cable Pin Configuration

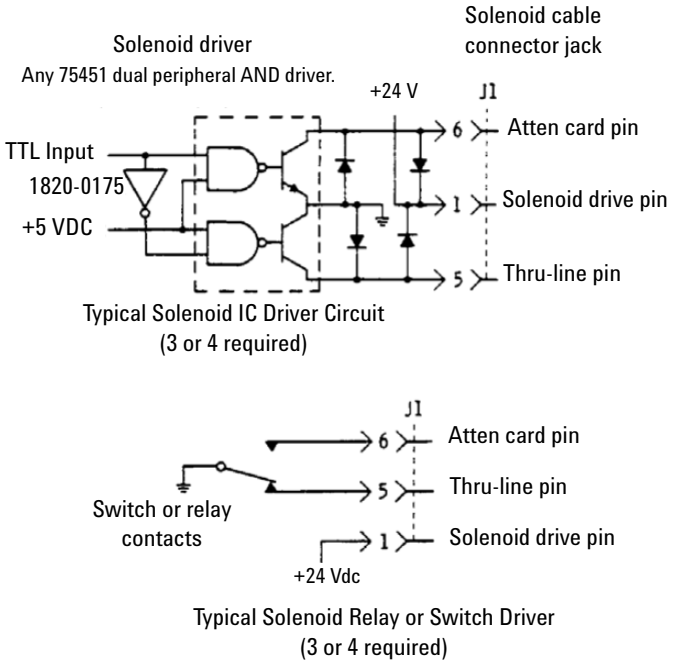

Figure 3 Typical Solenoid Coil Driver Circuit

Specifications

Frequency Range and Attenuation

Table 3 Frequency Range and Attenuation

Frequency Range	dc to 26.5 GHz
Attenuation	0 dB to 70 dB in 10 dB steps

Attenuation Accuracy

Table 4 Attenuation Accuracy

Attenuation Accuracy (± dB, referenced from 0 dB)				
Attenuation Selection (dB)	**dc–6.0 GHz**	**6.0–12.4 GHz**	**12.4–18.0 GHz**	**18.0–26.5 GHz**
10	0.3	0.4	0.5	0.7
20	0.5	0.5	0.6	0.8
30	0.6	0.7	0.8	1.0
40	0.7	0.9	1.1	1.5
50	0.8	1.0	1.2	1.6
60	1.0	1.3	1.4	1.9
70	1.1	1.5	1.7	2.3

Maximum Insertion Loss

(0.4 + 0.09 f) dB

where “f” is the frequency in GHz.

Attenuation Repeatability

±0.03 dB max to 18 GHz

±0.05 dB max to 26.5 GHz

(5 million cycles per section)

RF Power Handling Capability

1 W average, 100 W peak with maximum pulse width of 10 microseconds.

Solenoid Drive

For Agilent 8495K only.

Table 5 Solenoid Drive

Solenoid Drive	Coil Voltage	Switching Current
8495K	20 Vdc to 30 Vdc	125 mA at 24 V (approx.)

Switching Speed

Maximum 20 milliseconds including settling time.

Maximum SWR

Table 6 Maximum SWR

Instrument	Frequency Range (GHz)	Maximum SWR
8495D, 8495K	dc to 6.0	1.25
	6.0 to 12.4	1.45
	12.4 to 18.0	1.9
	18.0 to 26.5	2.2

Operating Life

5 million cycles per section.

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2 Environmental Specifications & Physical Dimensions

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Physical Dimensions 21

This chapter contains the environmental tests on the Agilent 8495D/K Attenuators that fully comply with Agilent Technologies' product operating environmental specifications. The physical dimensions are illustrated in the later section.

Environmental Specifications

The Agilent 8495D/K Attenuators are designed to fully comply with Agilent Technologies' product operating environmental specifications as shown in Table 7.

Table 7 Environmental Specifications

Temperature:	
• Operating	0 °C to +55 °C
• Storage	–40 °C to +75 °C
Humidity:	
• Operating	<95% relative
• Storage	<95% relative
Altitude:	
• Operating	<4600 m (15000 ft)
• Storage	<7600 m (25000 ft)
Shock:	
• Operating	10 Gs, six ms, on six sides, three blows
• Non-operating	500 Gs, 1.8 ms, in six directions
Vibration:	
• Operating	5 Gs, 34 Hz to 2000 Hz
EMC	Radiated interference is within the requirements of MIL-STD-461, RE02

Physical Dimensions

Table 8 shows the physical dimensions of the Agilent 8495D/K Attenuators.

Table 8 Physical Dimensions

Instrument	Dimensions[1]	Weight
8495D	Per Figure 4	15 oz 425 g
8495K	Per Figure 5	16 oz 454 g

[1] Dimensions are in millimeters and inches. Dimensions are for general information only. If dimensions are required for building special enclosures, contact your Agilent field engineer.

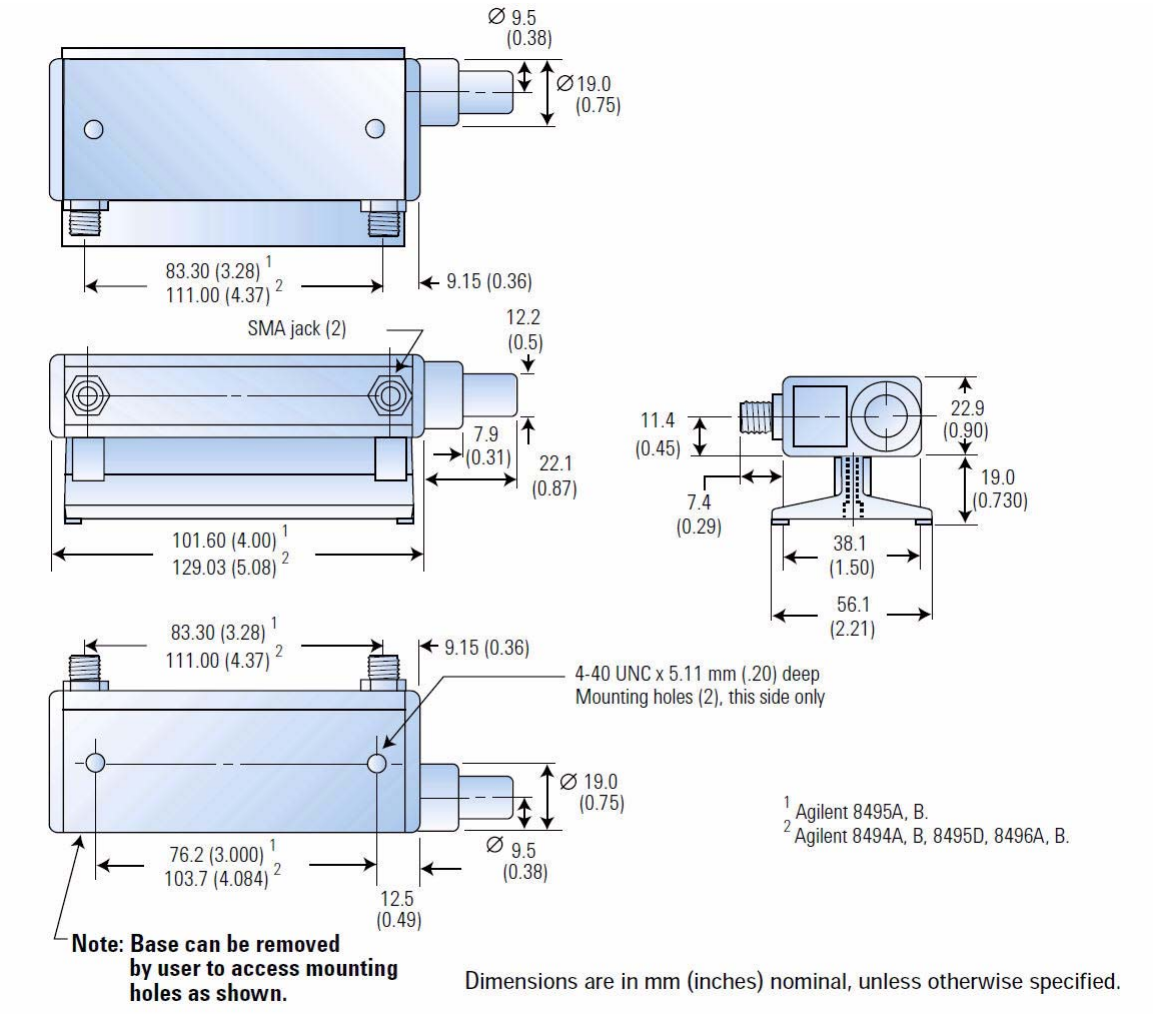

Figure 4 Dimensions of Agilent 8495D Attenuator

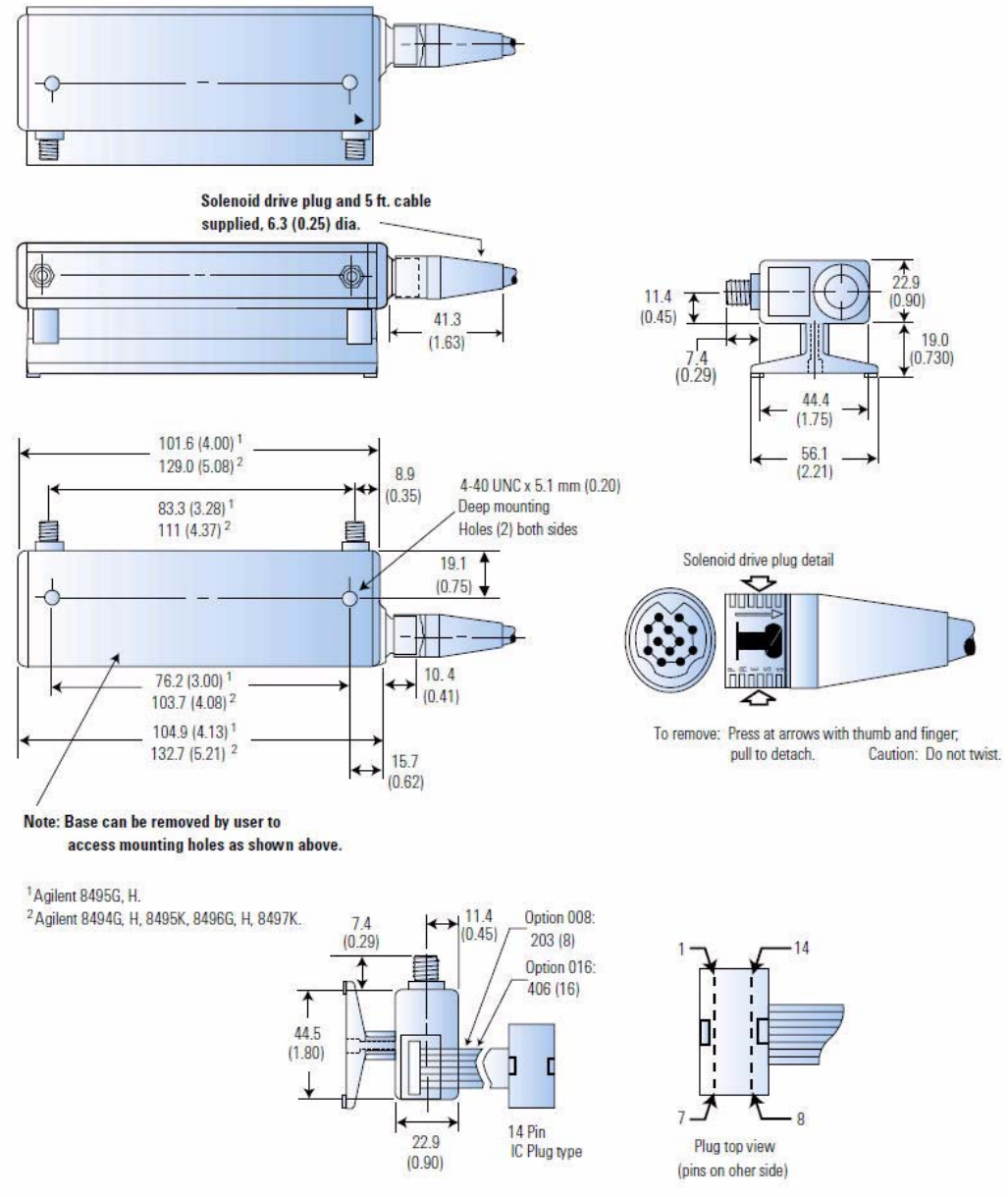

Figure 5 Dimensions of Agilent 8495K Attenuator

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This chapter describes the installation of the Agilent 8495D/K Attenuators. The operating instruction quick-check procedure is included for verification test prior to usage.

Installation

Initial Inspection

1. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked both mechanically and electrically.
   - Check for mechanical damage such as scratches or dents.
   - Procedures for checking electrical performance are given under "Operator's Check" on page 28 or "Performance Tests" on page 31.
2. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, contact the nearest Agilent Technologies Sales and Service office. Refer to the Service and Support information in the front matter of this manual. Agilent Technologies will arrange for repair or replacement of the damaged or defective equipment. Keep the shipping materials for the carrier's inspection.
3. If you are returning the instrument under warranty or for service, repackaging the instrument requires original shipping containers and materials or their equivalents. Agilent Technologies can provide packaging materials identical to the original materials. Refer to Service and Support information in the front matter of this manual for the Agilent Technologies nearest to you. Attach a tag indicating the type of service required, return address, model number and serial number. Mark the container ***FRAGILE*** to insure careful handling. In any correspondence, refer to the instrument by model number and serial number.

Mating Connectors

The APC 3.5 connector is a 3.5-mm air line connector that will mate with the SMA type connectors. The SWR performance of this hybrid connection is similar to a mated pair of SMA connectors when used within the frequency range of the SMA connector.

Option

The attenuators are configured with the APC 3.5 female connectors and are designated as Option 004.

CAUTION When installing the instrument, make sure that the connectors do not support weight or bear torque. The preferred procedure is to set up all equipment in position before connecting the instrument. Either connector may be used as the input or output connector.

Installation Instructions

The 8495K solenoid drive cable connector plug is connected by aligning the plug (P1) with the jack (J1) on the attenuator, and then pushing the plug over the jack. The plug is removed by grasping the ribbed sides of the plug and squeezing them together while pulling back until the plug clears the jack.

Operating Instructions

CAUTION Do not apply RF power greater than 1 W average, or 100 W peak with a maximum pulse width of 10 microseconds. If these limits are exceeded, the attenuators may be damaged.

CAUTION For the 8495K, do not ground both solenoid drive pins of the programmable attenuator at the same time. This causes rapid cycling of the solenoid and could reduce the operating life of the attenuator. The rapid cycling may produce a buzzing sound from the attenuator.

Operating Information

Either RF connector may be used as the input or output connector. Connect the solenoid drive cable of the programmable attenuator to the solenoid drive connector (Jl). By applying the proper voltage and grounds to the proper pins of Jl, the attenuator will either increase or decrease the amount of attenuation as selected.

Operator's Check

The Operator's Check is supplied to allow the operator to make a quick check of the instrument prior to use or if a failure is suspected.

Description

The attenuator is driven from a 50-ohm signal source at 1 kHz. The output level from the attenuator is detected by a narrow-bandwidth voltmeter. The attenuator and detector range switches are stepped together and the variations in level noted. This verifies that each attenuator section is being properly switched and checks the low-frequency accuracy of the attenuator.

NOTE The SWR meter used in this check is calibrated for a square-law detector. Therefore, the range changes and errors (read in dB) are twice that indicated by the meter.

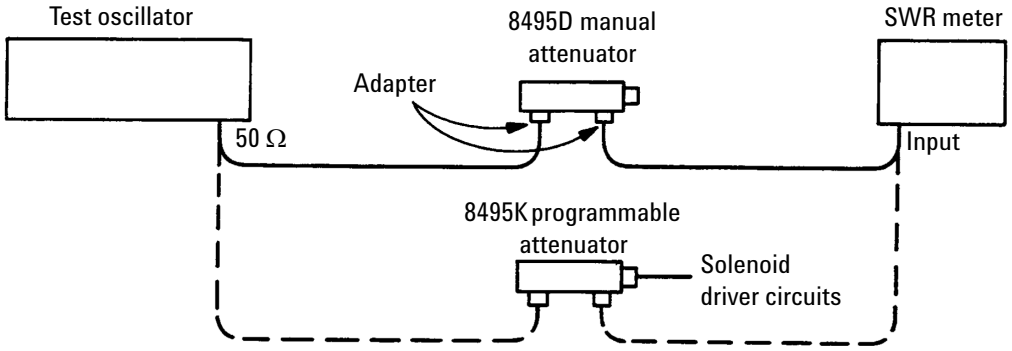

Figure 6 Operator's Check Setup

Procedure

1. Connect equipment as shown in Figure 6 on page 29 with the attenuator set to 0 dB.
2. Set the test oscillator to 0.3 Vrms at 1 kHz.
3. Set SWR meter range to 2 dB (expanded) and adjust its bandwidth to center of adjustment range. Fine-tune the oscillator frequency to obtain maximum meter indication.
4. Set attenuator and SWR meter range switch as listed in Table 9 and verify that the SWR meter indicates within the limits shown.

Table 9 Attenuator and SWR Settings

SWR Meter Range (dB)	Attenuation	Meter Indication (dB)		
	8495D/K	Minimum	Actual	Maximum
2	0	–	Set to 0.5	–
6	10	1.20	–	1.80
12	20	0.15	–	0.85
16	30	1.05	–	1.95
22[1]	40	–0.40	–	1.40
26[1]	50	0.50	–	2.50
32[1]	60	–0.60	–	1.60
36[1]	70	0.35	–	2.65

[1] Adjust range by 2 dB, if needed, to obtain an on-scale indication.

Performance Tests

The Agilent 8495D/K Attenuators can be tested to the accuracy of the specifications with a network analyzer or equivalent equipment of suitable accuracy. If a network analyzer is available, test instrument using the procedure in the analyzer's operating manual.

Service Instructions

Adjustment

The Agilent 8495D/K Attenuators do not have internal adjustments and should not be opened.

Repair

The Agilent 8495D/K Attenuators are not recommended for repair as most components are not easily removed.

Maintenance

The connectors, particularly the connector faces, must be kept clean. For instruction on connecting and care of your connectors, refer to Microwave Connector Care Quick Reference Card (08510- 90360).

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